

N 9 1 - 3 2 6 8 9

Monitoring, Analyzing and Modeling Global Climate

John R. Christy

University of Alabama in Huntsville

Research Activities June 1990 - May 1991

1. Diabatic Heating Rate Estimates

NASA Funding: 1988-90 Global Scale Processes; 1991- EOS

Christy, J.R., 1991: Diabatic heating rate estimates from European Centre for Medium-Range Weather Forecasts analyses. *J. Geophys. Res.*, **96**, 5123-5135.

2 Conference Preprints, 1 Workshop presentation

One year of Graduate Student support for Remata Reddy at UAH

Diabatic heating rate estimates as residuals of the dry thermodynamic equation have been generated for 1 May 1985-December 1989 in pentad resolution. Published results show moderate correlations (~.6) between heating rate and outgoing long-wave radiation for periods under 90-days in the tropics and many extratropical locations. Further work must await a systematic reanalysis of the base ECMWF data because discontinuities create spurious "climate changes".

2. Community Climate Model Simulations

NASA Funding: 1990 EOS; 1991 - proposed to modeling research

1 Conference Preprint, 1 Workshop presentation.

Nine years of simulation with the CCM1 using R15 and observed SSTs shows the model retains significantly more heat at the surface and in the free atmosphere than does the actual earth system. Current and future research will search for the reasons for the spurious warmth and seek to alleviate the problem. A post-processor for the CCM1 with capabilities to produce simulated MSU brightness temperatures was written by the investigator.

3. Microwave Sounding Unit Brightness Temperatures

NASA Funding: 1990 Climate, 1991- proposed from Climate

Christy, J. R., 1992: Monitoring global temperature changes from satellites, *Global Climate Change: Implications, Challenges and Mitigation Measures*, S. K. Majumdar, L. S. Kalkstein, B. Yarnell, E. W. Miller and L.M Rosenfeld, Eds. Pennsylvania Academy of Science.

Spencer, R. W., J. R. Christy and N. C. Grody, 1990: Global atmospheric temperature monitoring with satellite microwave measurements: Method and results 1979-84. *J. Climate*, 3, 1111-1128.

Spencer, R. W. and J. R. Christy, 1991: Precision and radiosonde validation of satellite gridpoint temperature anomalies, Part I: MSU channel 2. *J. Climate* (submitted).

Spencer, R. W. and J. R. Christy, 1991: Precision and radiosonde validation of satellite gridpoint temperature anomalies, Part II: A tropospheric retrieval and trends during 1979-90. *J. Climate* (submitted).

3 Conference Preprints, 5 Presentations

Operational cooperation with Climate Analysis Center (NOAA)

Techniques were refined considerably and validation studies were carried out to verify the globally distributed free atmosphere temperature anomalies derived from MSU data. The precision is such that detailed, long-term climate monitoring is well within the capability of these data.

4. MSU and Monitoring Global Climate

NASA Funding: small portion from Climate

Trenberth, K. E., J. R. Christy and J. W. Hurrell, 1991: Monitoring global monthly mean surface temperatures. *J. Climate* (submitted).

Hurrell, J. W. and K. E. Trenberth, 1991: An evaluation of monthly mean MSU and ECMWF global atmospheric temperatures for monitoring climate. *J. Climate* (submitted).

1 Conference Preprint, 4 presentations

In Trenberth et al., the lack of consistent correlations over the oceans between MSU and surface data was examined. Variances due to signal and error were

calculated for MSU and sea surface gridded anomalies. It was shown that surface anomalies for most of the ocean south of 20°N are not accurately known even in the present day.

In Hurrell and Trenberth, the global validity of the MSU was demonstrated and that discontinuities in the ECMWF data indicated false climate changes. Knowledge of the free atmospheric temperatures from the MSU is necessary as they monitor the levels that should show the signal of the anticipated enhanced greenhouse effect in the most unambiguous manner.

An investigation with J. Goodridge (retired state climatologist of California) has shown that for California, the stations monitored by the WMO and used in data sets such as GISS and East Anglia do not represent the actual long term temperature trends. This was shown by studying those WMO stations as part of the total 112 stations in the state. The median decadal trend of all 112 was $+0.067^{\circ}\text{C}$ while those of the stations used in long-term trend construction for GISS gave a $+0.150^{\circ}\text{C}$ value. Given the fact that considerable urbanization has infected the California records, the true temperature trend is likely much less than the median $+0.067^{\circ}\text{C}$. Also note that GISS extrapolates values to 1200 km off-shore, so that warm-biased California data affect an area over five times that of the state's actual size. Further work will quantify the differences between many-station trends versus those of WMO stations.

